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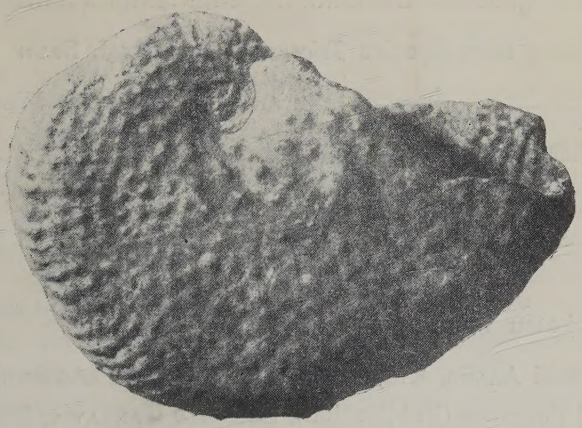

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TRANSACTIONS

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317. ON AN *ATURIA* FROM THE PORONAI SHALE IN HOKKAIDO*

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北海道幌内頁岩産の *Aturia* について.—空知郡美流渡万字地区の幌内頁岩産の *Aturia* は *A. yokoyamai* に同定され，漸新世の黒潮に乗って古石狩湾まで漂流したものと考へられる。因みに三池炭田始新統産の所謂 *A. zigzag* には2種あり，共に縫合線その他で *A. yokoyamai* と異る。三池産のうちで殻の扁平円板状をなす方に新称 *A. nagaoi* を提唱する。幌内頁岩産の *A. yokoyamai* の内部構造を見るに，最後の螺管の腹側では連鎖環が殆んど痕跡的となるのが認められる。　小林貞一

The discovery of *Aturia* in Central Hokkaido is interesting particularly because it indicates the northern limit of its distribution in Japan or probably on the western side of the Pacific Ocean, although its occurrence is known from Alaska on the eastern side (Schenck, 1913).

The specimen in question was procured by Nishinomiya, (1951) in a marly nodule in the Poronai shale formation on the southeast bank of the Suidonosawa, or the valley of water reservoir, 500 m. above its junction with the Poronai river, between Manji station and Manji coal-mine station, Sorachi-gun, Hokkaido. I wish to record here my sincere gratitude to Mr. Katsuhiko Nishinomiya, the collector, and Prof. Susumu Matsushita of the Kyoto University for the privilege to study this specimen in the collection of that university.

Although the Manji specimen is imperfect, it is so similar to *Aturia yokoyamai* that I have once called it *A.* cfr. *yokoyamai* (1954). According to K. Matsushita, (1949), *A. yokoyamai* occurs at various places in Northwestern Kyushu in some Palaeogene formations and its close ally in the Ariake formation whence *Camerina amakusensis* (Yabe and Hanzawa), 1925, and some other foraminifers of the early Lutetian or Cuisian age are described. Therefore mutation among the Palaeogene forms of Kyushu is an interesting subject of study. I do not intend at this moment to go very far in the taxonomic problem. But only a brief note is given here that *A. yokoyamai* comprises more than two species and the Manji specimen belongs to *A. yokoyamai* s. str. which is an Oligocene species.

Nagao (1926) proposed *Aturia yokoyamai* for the so-called *Aturia zigzag* from Japan, but his diagnosis is evidently based on his Oligocene specimens, because he states that "lateral lobe — usually extending as far as the preceding suture—" (page 29), and gave dimensions of two syntypes from Asakura coal-mine and Meinohama, Fukuoka city.

He identified Yokoyama's two specimens of *A. zigzag* from Miike coal-field

* Received Sept. 4, 1956; read at the 64th Meeting of the Palaeontological Society of Japan, Oct. 6, 1956, at Kyoto.

with his new species, noting that YOKOYAMA's *zigzag* on pl. 3, figs. 8 a–b is a deformed *yokoyamai*.

YOKOYAMA's two illustrated specimens were procured from the Eocene Manda formation, whereas all or most of NAGAO's were procured from Oligocene formations. While these Oligocene ones are large, growing more than 25 cm. in diameter, YOKOYAMA's *zigzag* in figs. 1 a–b, pl. 3, is small, only about 6.3 cm. in diameter. This is distinct from NAGAO's *yokoyamai* in the deeper ventro-lateral lobe which is extended as far as a third of the ventral saddle of the preceding suture. None of NAGAO's specimens, however, shows such a duplication of septal sutures. Because this difference matches with the time displacement between the two forms, *A. nagaoi* is proposed for the Eocene form as typified by the specimen of YOKOYAMA's *zigzag* in figs. 1 a–b on pl. 3.

In YOKOYAMA's, *zigzag* in figs. 8 a–b, on pl. 3, the ventro-lateral lobe is inserted into the preceding as in *A. nagaoi*. This is, however, quite different from *A. nagaoi* in its shorter septal interval and higher lateral saddle in relative to its breadth. Accordingly its ventral saddle is extraordinarily broad and large. Like *Aturia triangula* STENZEL (in MILLER, 1947, pl. 96, figs. 1–5), the whorl is unusually broad and subtriangular in section, while it is narrow and discoidal in *A. nagaoi*. These differences appear not wholly attributable to secondary deformation. Though it is such an imperfect specimen to give a new name, I think it to reveal a new species of *Aturia*.

As shown in text-figure 1, the Manji specimen coincides with the Asakura specimen of *A. yokoyamai* in the growth of the spire, septal distance and course of the septal suture. The septal interval is evidently longer in *A. yokoyamai* including the Manji specimen than in either *A. minoensis* KOBAYASHI (1954, KOBAYASHI and MASATANI, 1955) or *A. tokunagai* SHIMIZU (1926). The specimen of *yokoyamai* from Kyushu are often deformed. The two specimens from Meinohama, Fukuoka city (NAGAO, 1926, pl. 10, figs. 1, 1 a and pl. 11, figs. 1, 1–c), for example, have angulate venters indicating their strength of lateral compression. In the whorl section the Manji specimen resembles the undeformed one from Meinohama (NAGAO, pl. 10, figs. 2, 2 a), having a well rounded venter. Now I find no reason that the Manji specimen should be excluded from *Aturia yokoyamai*, because it matches with that species in all of the observable characteristics. It is then an exotic southern element in the Poronai fauna.

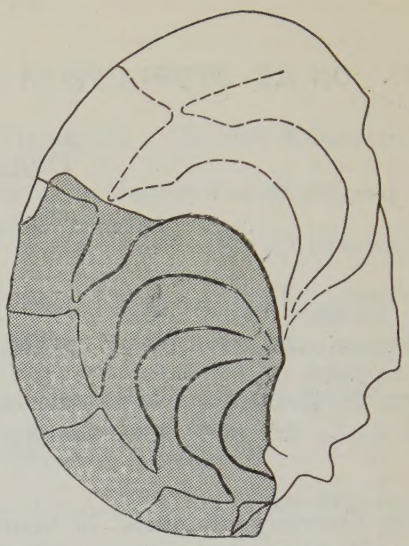

Figure. 1. *Aturia yokoyamai* NAGAO from the Poronai shale (shaded) and the same species from Asakura, N. Kyushu. (NAGAO, 1926, pl. 9, figs. 1, 1 a). ×3

The Poronai shale formation has long been thought Miocene in age and to

lie on the Palaeogene Ishikari series. Some years ago YABE (1951) pointed out that, though the Poronai is heteropic from the Ishikari series, it must be partly synchronous with the series. Subsequently in 1952, ASANO correlated the Poronai foraminiferan fauna with that of the Tumey formation in western North America which is in turn Rufugian or lower Oligocene to upper Eocene. TAKEDA (1953) on the other hand has shown in his study on the Molluscan shells that the Poronai fauna is Oligocene.

Although TAKEDA found some warm water inhabitants, cold water forms are predominant in the Poronai Molluscan fauna. Therefore it was previously tied up with the Aquitanian Asagai fauna and the Asagai-Poronai fauna considered the typical boreal fauna.

When *Aturia* is found together with warm water benthos, it is difficult to say definitely, whether it is indigenous or exotic to a fossil-coenesis, but like *A. tokunagai* in the *Thyasira-Phacoides* fauna in Prov. Hidachi, Ibaraki Pref., this is the case of *inclusion of a warm water necroplankton in a boreal benthonic fossil-coenesis.* The Manji specimen must have been a float on the proto-Kuroshiwo warm current which flew into the Palaeo-Ishikari bay in Central Hokkaido at least at the time of the Oligocene transgression.

The Poronai formation is a thick muddy sediment, more than 1,000 m thick, which was accumulated in a trough by the prorogenic subsidence. The shell of *Aturia yokoyamai* is better preserved in the marly rock of Manji than in coarse rocks of Northern Kyushu.

To see the internal structure the Manji specimen was cut longitudinally and polished. It is especially well preserved in the last whorl which is filled with dirt and minute oolites, while it is obscured in the inner volutions by crystallization.

On the dorsal side of the last whorl there is a thick white layer (2) in which white sheets are imbricated with an acute angle with the margin. In the

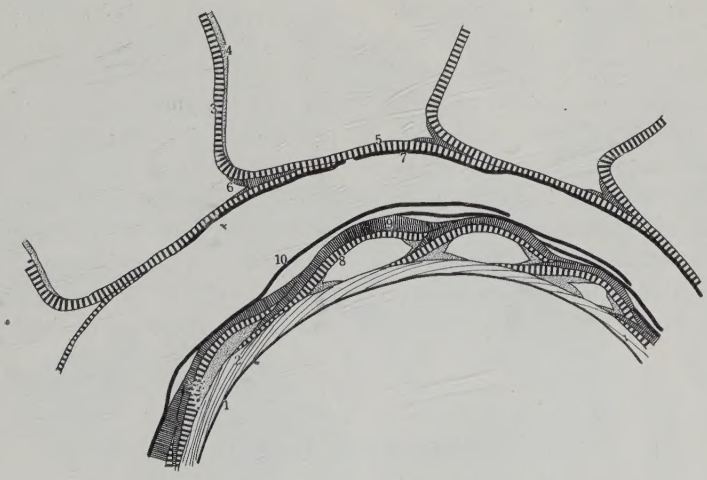

Figure. 2. Internal Structure of *Aturia yokoyamai* in Plate 13, See the text for its explanation.

transverse section, however, it is seen that this layer is abruptly thinning laterally. The inner side of the layer is stained by brown colour, but it is not so clear to be segregated from the white layer. On the other side there is also a thin layer (1) which is black or deep brown. A careful observation reveals that this is composed of double, instead of a single, layers, namely the outer layers of the ultimate and penultimate whorls. On the dorsal side of of this there is a very thin white layer, or the inner layer of the penultimate whorl.

In this polished section there are five camerae on the ventral side of the last whorl. Certain septa look to be composed of double layers. One of them on the adapical side which thins out near the septal neck, may be a hyposeptal deposit (4), although it is so regular as the septum (3) itself. Septa are bent at the necks gradually; septal funnels extended as long as one and a half of the camera height. The septal neck and the succeeding septal funnel (5) are lined with a thin layer of dark gray material (6) at their junction. Unless it is a relict, there is no connecting ring at least in this part of the siphuncular wall. The funnel is lined on the siphuncular side with a thin dark layer (7) which may be continuous or discontinuous at the adapical end of the funnel. No lining is, however, seen on the last septal funnel.

Because this section is a little oblique to the median plane, the siphuncle narrows abruptly on the adoral side where the camerae appear on the dorsal side. The thinning of the shell at the mural part of the septum is inrecognizable in the last whorl. The septum (8) there is coated by a connecting ring (9). Due to crystallization near the junction of a septum with its predecessor, it is difficult to say, how far the septum is extended to the adapical side. The endosipholinings (10) on this side of the siphuncle are not continuous, but invaginated one into another. There are some rooms between them as well as between a lining and septum. These spaces which are filled with dirt, are thickened in a lenticular shape on the section near a junction between two septa.

The siphuncle of this nautiloid is holochoanoidal and orthochoanitic. In other words, the septal funnels are long and invaginated one after another to close the intervals between the septal necks. The siphuncle is tubular, although the funnel on the dorso-lateral side may be somewhat convex inward between two septal necks.

In the inner volutions (Pl. 13) the siphuncle and camerae are mostly filled with crystals of impure calcite. Septa are gone at places by crystallization, but fortunately the structure of the siphuncular wall is nicely preserved in the penultimate whorl. This is about the same growth stage as the specimen of *Aturia peruviana* OLSSON on which MILLER and THOMPSON made an observation (1937). In the present siphuncle of this stage it is seen that long septal funnels which are dark coloured are separated from each other by a thin

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Explanation of Plate 13

Polished section of *Aturia yokoyamai* NAGAO from the Poronai Shale in Central Hokkaido showing the internal structure. ×2. See Figure 2.

light coloured layer, or so-called connecting ring by these authors. This light coloured material can be seen also on the adapical part of the same volution to fill up the narrow interstice between the funnels which in turn form a cone-in-cone structure. It is further noteworthy that the white inner layer of the outer shell becomes thinner at places where the shell is backed by the septum. Thus the internal structure of this whorl agrees with what the joint authors have illustrated.

In the Manji specimen it is found that the siphuncular structure develops from the *olssoni* stage in the penultimate whorl to the *yokoyamai* stage in the ultimate whorl. The chief difference between the two stages lies in the loss of the so-called connecting ring by direct contact of a funnel with the preceding which is clearly seen on the camerate side of the siphuncle. The relict of the ring is seen there only near the septal neck.

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318. THREE NEW MIOCENE SPECIES OF *CALLIANASSA* FROM NAGANO PREFECTURE*

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長野県産中新世 *Callianassa* の三新種：*Callianassa Shikamai* n. sp.：長野県下伊那郡富草村雲雀沢，富草層群新木田層，岩井四郎採集。

Callianassa Tanakai n. sp.：東筑摩郡四賀村会田区清水沢（旧五常村西ノ宮），小川層最下部，降簱正幸，田中邦雄採集。

Callianassa Yagii n. sp.：長野市小田切，小鍋田中，にごり沢，論地頁岩層，八木健三採集。

上記の3新種を記載した。*C. Shikamai* は *C. titaensis* の系統の種である。*C. Tanakai* は小形で腕節及掌節の形態により他の *Callianassa* から区別される。*C. Yagii* は左の掌節のみであるが，その平滑な表面に特徴がある。

今泉力蔵

Introduction

Of the three new species of *Callianassa* from the Neogene Tertiary of Nagano Prefecture described here, the first species, *Callianassa Shikamai* n. sp. was collected from the Arakida formation of the Tomikusa group at Hibarizawa, Tomikusa-mura, Shimoina-gun, Nagano Prefecture, by Shiro Iwai of the Iida-Takamatsu High School. This species was reported by T. Shikama in 1954 as *Callianassa* cfr. *inornata* Nagao and Huzioka, 1938 and is now named as *Callianassa Shikamai* n. sp. in honor of the first recorder (Shikama, p. 87, Pl. VII, Fig. 6). *Callianassa Shikamai* n. sp. is very close to *Callianassa titaensis* Nagao, 1941 and comprizes one group with the latter species in contrast to the other group of Hokkaido, composed of *Callianassa muratai* Nagao, 1932 and *Callianassa elongatodigitata* Nagao, 1941.

The second species, *Callianassa Tanakai* n. sp. was collected in 1951 from Nishinomiya, Shimizu-zawa, Aida, Shiga-mura, Higashi-Chikuma-gun, Nagano Prefecture by Mr. Masayuki Furuhata, then a student of the Gojo Middle High School, and offered to the writer by Mr. Kunio Tanaka of the Geological Institute of the College of Education, Shinshu University. Specimens of *Callianassa Tanakai* is small but does not belong to the second pair of chelipeds of the other species of *Callianassa*.

The third species, *Callianassa Yagii* n. sp. was collected by a student of the Otagiri Primary School in 1954 from the Ronji Shale formation at Nigorizawa, Konabe-tanaka, Otagiri, Nagano City and was put at the writer's disposal through the courtesy of Professor Kenzo Yagi. *Callianassa Yagii* n. sp. is the palm only, but clearly differenciated from other species of *Callianassa*.

Family Callianassidae

Genus *Callianassa* Leach

Callianassa Shikamai n. sp.

Pl. 14, Fig. 1–5,

Paratypes:—No. 1: Right cheliped, im-

* Received Oct. 27, 1956; read Oct. 20, 1956.

pression showing the outer surface; length of manus including propodal finger, 32 mm; length of palm, 17 mm; width of palm, 19 mm; length of dactylus finger, 22 mm; length of carpus, minimum, 7.5 mm, maximum, 11 mm; width of carpus, 13 mm; length of merus, 18 mm±; length of ischium, 14 mm, Fig. 1.

No. 2: Right cheliped showing the outer surface with fragments of ischium, other parts of appendages and cephalon; length of palm, 19 mm; width of palm, 21 mm, Fig. 2.

No. 3: Impression of left cheliped showing the inner surface; length of manus including propodal finger, 30 mm; length of palm, 13 mm; width of palm, 16 mm; length of propodal finger, 17 mm; length of carpus, 8 mm; width of carpus, 12 mm, Fig. 3.

No. 4: Right cheliped showing the outer surface with fragments of ischium and cephalon, and the cast of dactylus and anterior part of chela: length of palm, 18 mm; width of palm, 16 mm; length of dactylus finger, 18 mm; length of carpus, 9 mm; width of carpus, 13 mm, Figs. 4 and 5.

Preservation:—Specimens are embedded in the grayish white tuffaceous fine sandstone.

Description:—Right cheliped is large, palm is slightly shorter than width; propodal finger is broad at the base and tapers abruptly; dactylus finger is robust and longer than propodal finger. Proximal margin of palm is nearly at right angle to the lower border, slightly convex in the middle and concave in the lower part, making rounded curve with the lower border. Upper border inclined to the proximal end, making a large rounded curve. Outer surface of palm is more convex than the inner surface, and has about three granules on the median longitudinal line and anterior one is larger than the other. Inner surface of palm has about six large sockets in the middle of the anterior part. Propodal finger is shorter and thinner than the dactylus finger and slightly shorter than the palm, with a large tooth directing forward at the base of prehensile edge; the lower border bent upward abruptly in the distal extremity; inner surface has the longitudinal ridge with two vertically elongate large sockets.

A longitudinal series of about five fine granules along from the lower border of the inner surface of the propodal finger to the palm is faintly preserved.

Dactylus finger is stout, and longer than the palm, its distal extremity projecting far beyond that of the propodal finger, bent downward, with four vertically elongate large sockets.

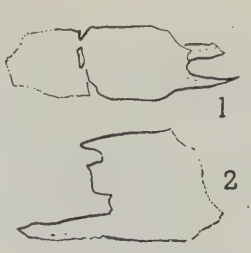
Carpus is two-thirds of the length of the palm, the upper part of its proximal border is very convex in outline.

Left manus is slender and thinner than the right one; palm shorter than width, with about five granules at the inner surface of the middle of its anterior part at the base of the propodal finger. Propodal finger has a large tooth directing forward at the base of prehensile edge. The shape of carpus is similar to the right one.

Locality and geological horizon:—Hibari-zawa, southwest of Furushiro, Tomikusa-mura, Shimoina-gun, Nagano Prefecture. (Tokimata Sheet), lat. 35° 21′19″N., long. 137°47′32″.4E., IGPS loc. no. Nn-6, Shiro Iwai coll. IGPS coll. cat. no. 79486. Arakida formation, Tomikusa group, Middle Miocene.

Remarks:—*Callianassa Shikamai* n. sp. is very close to *Callianassa titaensis* Nagao, 1941 and the former species is generally weaker and slender than the latter species. The differences between

the two species are as follows. The carpus of *Callianassa titaensis* is quadrate in lateral view and the carpus of *Callianassa Shikamai* n. sp. becomes slightly narrower proximally and has the convex part on the proximal upper part. The dactylus finger of *Callianassa titaensis* is stronger than the one of *Callianassa Shikamai* n. sp. and strongly bent downward especially at the extremity, and the dactylus finger of *Callianassa Shikamai* n. sp. bent gently downward. A series of sockets at the lower margin of the inner surface of *Callianassa titaensis* is distinct and it is faintly in *Callianassa Shikamai* n. sp.



Text-figs. 1–2: *Callianassa Tanakai* n. sp., ×2.
Text-fig. 1: A left chela, inner view.
Text-fig. 2: A right manus, inner view.

Callianassa Tanakai n. sp.

Pl. 14, Figs. 6–9, Text-figs. 1–2.

Paratypes:—No. 1: A left chela showing the inner surface, with the impression of the carpus, (Fig. 6, right), and the cast of the same chela showing the inner surface, with the carpus showing incompletely the outer surface, (Fig. 7). Length of palm, 6 mm±; width of palm, 5.5 mm±; length of propodal finger, 4 mm±; length of dactylus finger, 4 mm ±; length of carpus, 6 mm±; width of carpus, 5.5 mm±.

No. 2: A right large manus without the dactylus, showing the inner surface (Fig. 6, left). Length of manus, 8.5 mm ±; width of manus, 7.5 mm±; length of dactylus finger, 6 mm±.

Preservation:—The specimens are ill-preserved, embedded in medium gray hard sandstone.

Description:—Palm of left manus slightly longer than width, propodal finger slender and tapering distally. Dactylus finger relatively robust and broad, and abruptly becomes narrower distally. The distal end of the dactylus finger broken off and the cast shows that it slightly bent downward at extremity and is slightly longer than propodus. Interdigital sinus between fingers broad and deep. Carpus long, and almost two thirds of the length of manus. Manus-carpus articulation nearly straight. The inner surface of palm is smooth, with a few granules on the distal lower part. A row of granules can be seen along the inner surface of the dactylus finger. Propodal finger has two rows of granules, each row is composed of three or four granules. On the lateral side of the inner surface, dactylus finger has four or more distinct granules, of which three make a longitudinal row.

Right manus has the serrations along the lower margin of the manus and the propodal finger.

Localities and geological horizon:—Nishinomiya, Shimizu-zawa, Aida, Shigamura, Higashi-Chikuma-gun, Nagano Prefecture. (Shinano-Ikeda Sheet), lat. 36°20′54″N., long. 137°58′9″E., IGPS loc. no. Nn-7, Kunio Tanaka coll., 1951, IGPS coll. cat. no. 79487. Lowermost of Ogawa formation, Middle Miocene.

Remarks:—This small *Callianassa* is close to *Callianassa muratai* Nagao, 1932 in the shape of the manus and the carpus and distinguished from the latter in the ornamentations of the surfaces of the palm. *Callianassa Tanakai* n. sp. is easily distinguished

from other species of *Callianassa* by the narrow propodus, the broad and deep interdigital sinus and the serrations of lower margin of manus.

Callianassa Yagii n. sp.

Pl. 14, Figs. 10–15, Text-figs. 3–8.

Holotype:—A left palm only, separated from matrix, length of palm, 13 mm; width of palm, 11 mm; thickness of palm, 6 mm.

Description:—Left palm subrectangular, slightly longer than width, becomes slightly narrower from the proximal to the distal end; external surface is very convex in a vertical direction, and is smooth whenever the surface layer is preserved; lower border is faintly sinous, proximal part of lower border is convex and distal part concave; the lower edge makes a sharp eave to the inner side with about ten serrations; upper border is broadly rounded in shape, the anterior part of the upper surface with a group of about nine granules at one fourth of the length behind the distal margin, the granules are small and oblong in shape. Inner surface of palm weakly convex in transverse and longitudinal directions; upper part makes a steep

Explanation of Plate 14

Figs. 1–5. ***Callianassa Shikamai*** n. sp. from Hibari-zawa, south-west of Furushiro, Tomikusa-mura, Shimoina-gun, Nagano Prefecture, IGPS coll. cat. no. 79486. Arakida formation, Tomikusa group, Middle Miocene.

Fig. 1. Paratype No. 1, right cheliped, impression showing the outer surface, ×3/2.

Fig. 2. Paratype No. 2, right cheliped showing the outer surface with fragments of ischium, other parts of appendages and cephalon, ×3/2.

Fig. 3. Paratype No. 3, left cheliped, impression showing the inner surface, ×3/2.

Fig. 4. Paratype No. 4, right cheliped showing the outer surface, with fragments of ischium and cephalon, ×3/2.

Fig. 5. Cast of paratype No. 4 showing the outer surface of dactylus and anterior part of palm, ×3/2.

Figs. 6–9. ***Callianassa Tanakai***, n. sp., Nishinomiya, Shimizu-zawa, Aida, Shiga-mura, Higashi-chikuma-gun, Nagano Prefecture, IGPS coll. cat. no. 79487. Lowermost Ogawa formation, Middle Miocene.

Fig. 6. Paratype No. 1, a left chela showing the inner surface with the impression of carpus (right hand), and paratype No. 2, a right large manus without dactylus showing the inner surface, (left hand), nat. size.

Fig. 7. Cast of paratype No. 1 showing the inner surface of chela with the carpus showing incompletely the outer surface, nat. size.

Fig. 8. A four times enlarged photo of fig. 6.

Fig. 9. A four times enlarged photo of fig. 7.

Figs. 10–15. ***Callianassa Yagii*** n. sp., holotype, Nigorizawa, near Konabe-tanaka, Otagiri, Nagano City, IGPS coll. cat. no. 79488. Ronji Shale formation, upper Miocene.

Fig. 10. Outer surface, ×2.

Fig. 11. Inner surface, ×2.

Fig. 12. Anterior view, ×2.

Fig. 13. Posterior view, ×2.

Fig. 14. Upper view, upper side is the outer surface, ×2.

Fig. 15. Lower view, lower side is the outer surface, ×2.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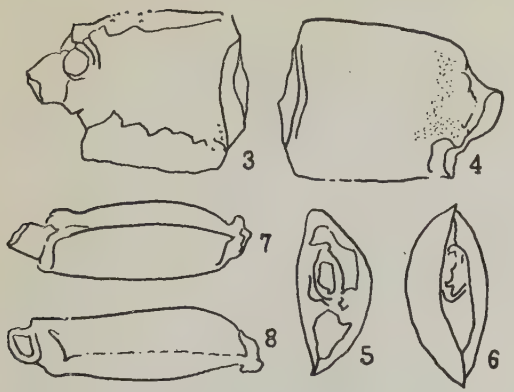

Text-figs. 3–8: *Callianassa Yagii* n. sp., ×1.8.
Text-fig. 3: Outer view.
Text-fig. 4: Inner view.
Text-fig. 5: Anterior view.
Text-fig. 6: Posterior view.
Text-fig. 7: Upper view.
Text-fig. 8: Lower view.

slope; middle part convex with numerous oblong, irregularly set pavements belonging to a lower layer, and the lower part concave longitudinally.

Proximal margin of the articulation of the palm with the carpus is incomplete. Proximal border of outer surface concave and forms a terrace with the manus-carpus articulation, and its margin is incomplete. Proximal border of the inner surface concave and has a broad furrow between the manus-carpus articulation. The distal part of the outer surface of the palm forms a gentle rise around the cavity for insertion of dactylus, and its margin is incomplete.

Interdigital sinus of the palm shallow, narrow, with a blunt granule on the outer upper corner of the sinus; the anterior part of this granule branches about three small granules. Anterior upper part of the inner surface of palm around the cavity for insertion of dactylus makes broad, and low irregular lobes. Section at the base of propodal finger subrhomboidal and dactylus is larger than propodus and oval in section at the base.

Locality and geological age:—Nigorizawa, near Konabe-tanaka, Otagiri, Nagano City. (Nagano Sheet), lat. 36° 39′19″N., long 138°7′25″.4E., IGPS loc. no. Nn-8, K. Yagi coll., 1954. IGPS coll. cat. no. 79488. Ronji Shale formation, upper Miocene.

Remarks:—*Callianassa Yagii* n. sp. is close to the left manus of *Callianassa elongatodigitata* Nagao, 1941 and is distinguished from the latter species by a very convex outer surface. The latter species has large granules on the anterior part.

In closing the present paper, the writer would like to express his hearty thanks to Mr. Shiro Iwai, Mr. Kunio Tanaka and Professor Kenzo Yagi for the specimens studied, and to Emeritus Professor Hisakatsu Yabe and Professors Shôshirô Hanzawa, Kiyoshi Asano and Kotora Hatai for their encouragements and advices.

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319. A TURONIAN *DAMESITES* FROM HOKKAIDO, JAPAN*

(Studies of the Cretaceous Ammonites from Hokkaido and Saghalien-XII)

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北海道産のチューロニアンの *Damesites*：今までの報告では，*Damesites* の進化史上，ギリヤーク世後期（ほぼチューロニアンに相当）に，記録の空白があつたが，今回その時期の地層からよい標本を得た。新種 *Damesites ainuanus* として，それを記載する。これはギリヤーク統下部階の *D. laticarinatus* から直接由来したとみなされる諸性質をもち，また *D. damesi intermedius* をへて，典型的な *D. damesi* や *D. sugata* へ発達する中途の過程を代表する。 松本達郎

Introduction

Recently I have described, combined with Dr. R. Saito, a Cenomanian species of *Damesites* and have demonstrated that the genus appeared in the Cenomanian (Saito and Matsumoto 1956). In another paper, in cooperation with Mr. I. Obata, I have presented a range chart of the species of *Damesites* in the Upper Cretaceous of Hokkaido and Saghalien (Matsumoto and Obata 1955). However we have had insufficient material to link the Cenomanian species with the Senonian ones. Only a form which is comparable with *Damesites semicostatus* (Yabe MS.) Matsumoto has been known in our Upper Gyliakian (i.e. approximately Turonian).

To fill this gap I have done further field work and succeeded in obtaining several interesting specimens from the Upper Gyliakian of the Ikushumbets area, Hokkaido. They represent a new species which probably connects *Damesites laticarinatus* Saito and Matsumoto with *Damesites sugata* (Forbes) and *Damesites damesi* (Jimbo). In this paper I describe it fully with some remarks on its affinities.

* Read June 20, 1956; received Nov. 10, 1956.

Systematic Description

Family Desmoceratidae

Genus *Damesites* Matsumoto, 1942

Damesites ainuanus sp. nov.

Pl. 15, figs. 1a, b, c, d, 2a, b, c.

Material: — Holotype: GK.** H4198, adult shell, from loc. Ik 2013d,*** Pombets near Ikushumbets, Hokkaido (T. M. Coll.). Paratypes: GK. H4199, immature, from loc. Ik $2013g_2$, Pombets (T. M. Coll.); GK. H4200 [=Muramoto Coll. 71], an example of the middle growth-stage, from loc. Ik 2012c, Pombets.

Specific diagnosis:—The shell is dis-

** GK.=Department of Geology, Kyushu University.

*** The stratigraphy of the Ikushumbets and the adjacent area, with an index of fossil localities, will be described in detail in a separate paper.

coidal, very involute and narrowly umbilicate. Whorls are compressed, with rather flattened and slightly divergent flanks and moderately arched venter. The ventral keel is smooth, moderately elevated and subrounded on the top; it has a broad base, which is bordered on both sides by faint longitudinal depressions. On the internal mould the keel is low and broad. The umbilicus is crater-like with a rounded or subrounded margin and a steep or nearly perpendicular wall.

The surface of the shell is nearly smooth, but narrow riblets and striae are faintly discernible on the ventrolateral part of the body whorl.

Constrictions are frequent on the internal mould of the body whorl and the late part of the septate whorl, but less so in the inner whorls. They are rather shallow and prorsiradiate, showing only slight flexuosity on the sides and prominent projection on the venter.

The sutureline is of *Desmoceras* type, much resembling that of *Desmoceras kossmati* Matsumoto (1954, p. 251, text-fig. 1 [471]), and is very finely incised.

Measurements:—(in mm.)

Specimens	Diameter	Height	Breadth	(B/H)	Umbilicus	(%)
GK. H4198 (body whorl)	85.5	44.5	29.2(+)*	(0.66)	10.2	(12)
„ (at the last septum)		32.5	23.2	(0.71)		
GK. H4199	25.4	14.3	11.0	(0.76)	2.4	(9)
GK. H4200	48.5	26.8	20.3	(0.75)	4.8	(10)

Occurrence:—All the specimens listed above and other comparable ones came from the lower part of the Upper Yezo Group exposed along the Pombets, a tributary of the Ikushumbets. Among the associated species there are *Inoceramus tenuistriatus* Nagao and Matsumoto, *Inoceramus incertus* Jimbo, *Inoceramus teshioensis* Nagao and Matsumoto, *Scalarites mihoensis* Matsumoto, *Bostrychoceras* aff. *indicum* (Stoliczka) and *Prionocyclus* sp. The bed belongs to the upper part of the Upper Gyliakian and is referable to Upper Turonian.

Remarks:—The present species resembles *Damesites laticarinatus* Saito and Matsumoto (1956, p. 192, text-figs. 1a–c) from the Paleogyliakian (approximately Cenomanian) of Hokkaido in its general shell-form, rather broad keel, nearly smooth surface and pattern of the sutureline, but is distinguished from it by a more elevated keel and frequent and distinct constrictions. It is probably a direct descendant of that species.

In the curvature and frequency of constriction and the smoothness of the shell the present species is similar to *Damesites sugata* (Forbes) emended by Matsumoto and Obata (1955, p. 128, pl. 26, figs. 4a, b, 5a, b; pl. 27, figs. 3a, b, 4a–d). In *Damesites sugata* (Forbes) the whorl is much compressed with parallel flanks and the keel is much elevated, narrow and sharp, while in the present species the whorl is less compressed and has slightly divergent flanks and the keel is relatively low, broad and rounded. There is, furthermore, slight difference in the size of the umbilicus and in the roundness of the umbilical margin.

There is a peculiar form which has been called *Damesites damesi intermedius*

* The body whorl is slightly deformed.

MATSUMOTO (1954, p. 270, pl. vi [xxii], fig. 4a, b; MATSUMOTO and OBATA, 1955, p. 131, pl. 27, figs. 1, 2a, b) in the Lower and Upper Urakawan. This is very similar to the present form, but has a narrower and more acute keel, a slightly more inflated whorls and better developed riblets. It has been regarded as an intermediate form between *Damesites damesi* (JIMBO) and *D. sugata* (FORBES). Indeed it may be so, but it might also connect the present new species with typical *D. damesi* on one hand and with *D. sugata* on the other side. In other words it probably represents a critical diverging point from the ancestral form of *Damesites* (*D. ainuanus*) of the Gyliakian to the more advanced ones (*damesi-sugata*) of the Urakawan. In this respect it might be called "*D. ainuanus intermedius*", but from its close resemblance to typical *damesi* in shell-form and ornament as well as the intimate stratigraphic occurrence *D. damesi intermedius* is, I think, a suitable name.

Summary

A new species of *Damesites* from the Turonian of Hokkaido has been described. It fills a blank in the record of evolutionary history of the genus, linking the ancestral Cenomanian species and the Senonian ones.

In conclusion I express my thanks to Mr. C. W. WRIGHT in London for his friendly help and critical reading of the manuscript. I am indebted to Messrs. T. & K. MURAMOTO and Mr. T. OMORI who have assisted me in the field. Members of the Sumitomo Coal Mining Co. at Pombets have afforded facilities for my field work. A research grant given by the Ministry of Education has enabled me to carry on a field trip in Hokkaido.

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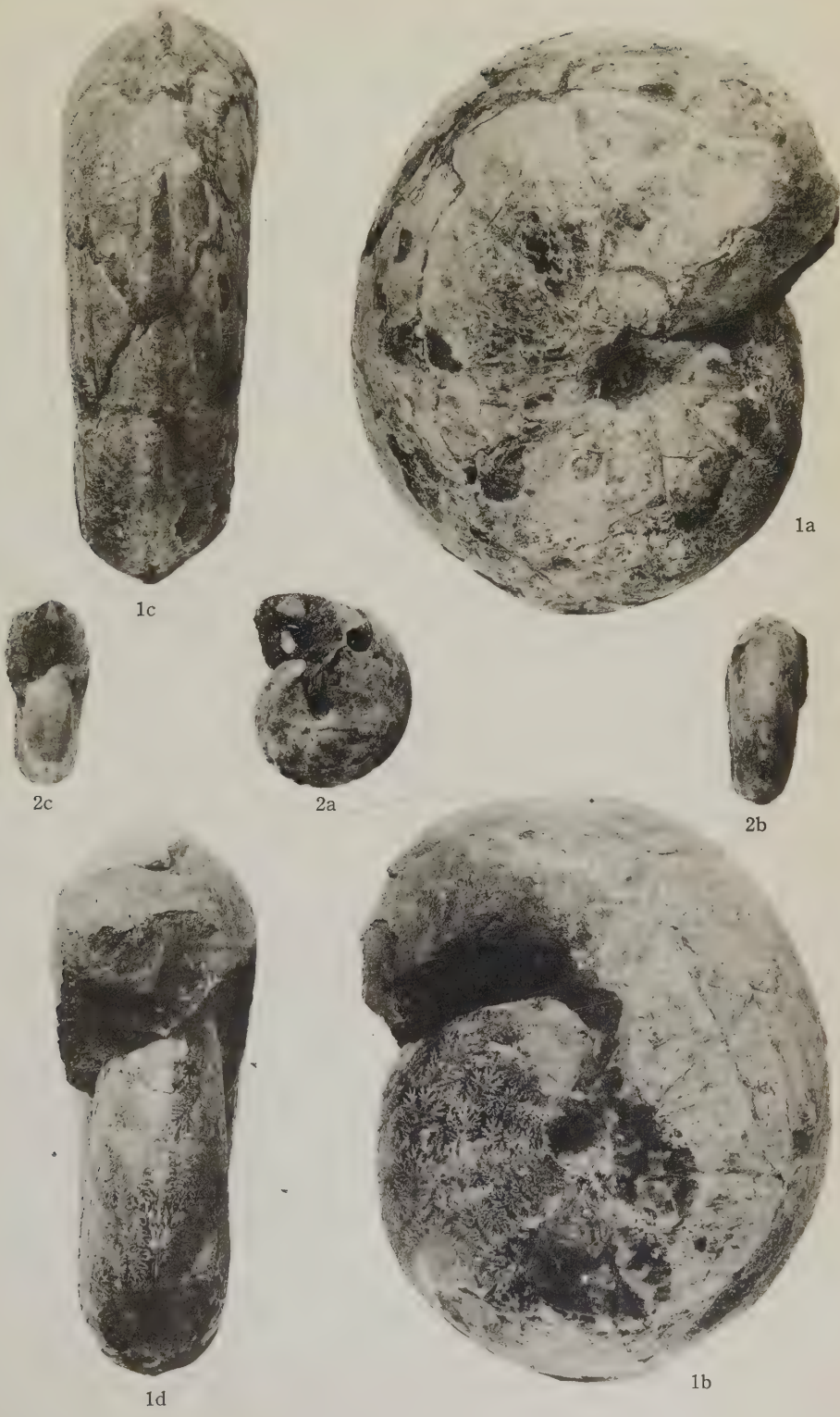
Explanation of Plate 15

Damesites ainuanus sp. nov.

Fig. 1. Two lateral (a, b), ventral (c) and frontal (d) views, natural size. Holotype, GK. H4198, loc. Ik 2013d, Pombets, lower part of the Upper Yezo Group, Ishikari Province, Hokkaido (T. M. Coll.).

Fig. 2. Lateral (a), ventral (b) and frontal (c) views, natural size. An immature example, GK. H4199, loc. Ik 2013 g, Pombets, lower part of the Upper Yezo Group, Ishikari Province, Hokkaido (T. M. Coll.).

Photos by T. MATSUMOTO and I. OBATA.


1a
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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 27, pp. 89–93, pl. 16, Sept. 30, 1957.

320. *RADULONECTITES*, A NEW PECTINID GENUS, FROM THE LIASSIC KURUMA GROUP IN CENTRAL JAPAN*

(Studies on the Liassic Pelecypods in Japan, 4)

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来馬層群産の帆立貝新属 *Radulonectites* について：来馬層群模式地附近の化石層は数種の pectinids を産することが 小林貞一（1935）によって知られていたが，この中の1種はその外形と表面装飾からみて，新属であることが判ったのでこれを記載する。 速水 格

In this paper the writer proposes *Radulonectites* as a distinct pectinid genus. Before its description the writer expresses his sincere thanks to Prof. T. Kobayashi of the University of Tokyo for the privilage of studying his collection and the supervision of this manuscript.

Family **Pectinidae** Lamarck

Genus *Radulonectites* Hayami, new genus

Type species:—*Radulonectites japonicus* Hayami, n. sp., Lias, Central Japan.

Diagnosis:—Shell highly inequivalve, inequilateral in right valve, acline or slightly opisthocline in mature, more or less higher than long; left valve more convex than right; antero-dorsal margin of shell-body profoundly sinuated in right valve, but the sinuation is shallow in left; byssal notch very deep; auricles well defined in each valve; right anterior one protruded forwards as in *Chlamys*, while others are subtrigonal and obtusely truncated at the extremities; almost straight radial grooves appear at first in middle stage, never bifurcate and gradually strengthened; umbonal region almost smooth except for faint concentric lines of growth.

Remarks:—*Radulonectites* is characterized by the *Pleuronectites*-like outline and radial grooves in adult stage.

In the smooth umbonal area it is sometimes similar to *Camptonectes* Meek (1864), flourished in the Jurassic and Cretaceous, but flabellate "*Camptonectes*-striations", curving outwards and often punctated, are absent in this genus. Its radial grooves are profound, nearly straight and widely spaced, if compared with the "*Camptonectes*-striations". As to the outline, it differs from *Camptonectes* (s. s.) or non-striated "*Camptonectes*" in the more inequilateral shell-body and deep byssal notch. Length is almost equal to or even larger than height in that genus, but the former never exceeds the latter in this genus. In *Pecten* (*Camptonectes*) *lens* Leanza (non Sowerby) (1942) radial striations are almost straight and distributed on the antero-ventral side. In outline it is so similar to the type species that it is referable to *Radulonectites*.

* Received Dec. 1, 1956; read Feb. 9, 1957.

In this type species the intervals among radial grooves look like *Chlamys*' radial costae, but a close examination soon proves that the smooth surface is carved by radial grooves which appear in middle stage and develop in mature stage. Incidentally, radial ribs, if present, diverge from the very umbones, and shells are almost equilateral exclusive of auricles in many species of *Chlamys*.

In outline the type species is fairly similar to *Pleuronectites laevigatus* (Schlotheim) (Philippi, 1900; Diener, 1925; Schmidt, 1928) from the Lower Muschelkalk in Germany, which has also a highly inequivalve shell, profound byssal notch and sigmoidal antero-dorsal margin of right valve. In that species, however, the surface is quite smooth except for fine concentric lines of growth.

Pleuronectites laterestriatus (Philippi) (1899; Schmidt, 1928), also from the Lower Muschelkalk, has a left valve of similar outline and fine radial striae in the antero-ventral side. That species was referred to *Streblopteria* McCoy by Philippi (1899) and is regarded as an abnormal species of *Pleuronectites* by Amano (1955). *Streblopteria* McCoy (1851) was thoroughly discussed by Newell (1937) as a late Palaeozoic genus of the Aviculopectinidae. Judging from the well defined auricles, deep byssal notch and literally partial ornaments, *laterestriatus* is referable to neither *Streblopteria* nor *Pleuronectites* but to this genus.

Streblochondria Newell (1937) is characterized by the lattice ornamentation in the umbonal area, nearly equivalve and poorly defined posterior auricles, although it looks sometimes close to this genus in outline.

Unfortunately, neither hinge structure nor musculature is known in the type species. Therefore, it is indeterminable directly from internal characters whether this genus belongs actually to the Pectinidae or to some other more primitive family. Ctenolia are often met with in *Pleuronectites*, and a clear inner resilifer is illustrated in *P. laevigatus* by Schmidt (1928). Because *Pleuronectites* seems the most intimate relative to this genus among the abovementioned Palaeozoic or Mesozoic pectinids, this may belong to the Pectinidae.

List of species:—

1. ***Radulonectites japonicus*** Hayami, Liassic, Central Japan.
2. ***Pecten*** (***Pleuronectites***) ***laterestriatus*** Philippi (1899; Schmidt, 1928), Lower Muschelkalk, Germany.
3. ***Pecten*** (***Camptonectes***) ***lens*** Leanza (1942), Liassic, Piedra Pintada.

The following species are similar to this genus, though the generic references cannot be warranted.

4. ***"Chlamys" kakanuia*** Marwick (1956), Hokonui System, New Zealand.
5. ***Chlamys*** sp. Dietrich (1933, pl. 8, fig. 130), Tendaguruschichten, S. E. Africa.
6. ***Chlamys*** sp. Dechaseaux (1936, pl. 4, fig. 6), Bajocian, Paris Basin.

Radulonectites japonicus Hayami, n. sp.

Plate 16, Figures 1–7.

Description:—Shell highly inequivalve, inequilateral especially in right valve, slightly opisthocline, higher than long, *Pleuronectites*-like in outline; posterior area develops more than anterior; left valve moderately convex but the convexity of right one is weak; hinge-margin straight; in right valve antero-dorsal margin of shell-body remarkably sigmoidal but not so much in left; postero-dorsal one almost straight in

each valve; ventral one gently arcuate, passing into postero-dorsal one, but incurving somewhat abruptly at the junction with antero-dorsal one in right valve; umbo fairly pointed, located slightly posteriorly and scarcely rising above hinge-margin even in left valve; apical angle about 110 degrees in adult stage, but it is much smaller in juvenalia; auricles large, well defined; right anterior one protruded forwards, linguiform, supported by a triangular auricular sulcus below; left anterior one fairly convex, slightly undulated, truncated subvertically; posterior one depressed, triangular, truncated with an obtuse angle of 120 degrees or more at the extremity in each valve, but its posterior margin slightly concave in left valve and feebly convex in right; both valves similarly ornamented with 65 to 70 almost straight radial grooves in maturity, although umbonal region is smooth except for faint concentric lines of growth; radial grooves unbranching, curving slightly outwards in anterior part, broadened gradually, almost as wide as their interspaces near ventral periphery; auricles sculptured also by several weak radials in adults except for right anterior one; ventral side and auricles marked with strong concentric lines of growth; ctenolium, resilifer and muscle system unknown.

Measurement in mm.	Length	Height	Thickness	Apical angle*	Grooves**
Holotype (MM 2689) bivalved	45.5	50.0	8.5	110°	67
Paratype (MM 2690) right valve	42.0	47.0	5.0	105°	66
Paratype (MM 2691) right valve	30.5	34.0	4.5	95°	68
(MM 2692) juvenile right valve	17.0	19.0	2.5	95°	12

Observation:—Many right valves and three bivalved specimens are at hand. The holotype (Figs. 2a, 2b, 2d) and adult paratype (Fig. 1a) are more or less compressed secondarily, but they show the outline and ornamentation in adult stage of this species. The aspects of the middle and early stages are represented respectively by a paratype (Fig. 6a) and a small right valve (Figs. 3a, 3b).

The juvenile shell is acline to slightly prosocline and somewhat *Chlamys*-like in outline. Its apical angle is comparatively small due to the sinuation of the antero-dorsal margin of the shell-body. The byssal auricle is fairly large, if compared with those of adults, and ornamented with two or three radial ribs which become obsolete later. The surface of shell-body is almost smooth, and radial grooves are, if present, very narrow, small in number and restricted to the antero-ventral side. It shows that radial grooves appear earlier in the antero-ventral than in the other part.

The shell-surface is liable to exfoliate, but the characteristic ornaments are completely preserved on the external moulds of three type specimens (Figs. 1b, 2c, 6b). None of artificial internal moulds*** reveals either resilifer or

* Maximum umbonal angle between antero-dorsal and postero-dorsal margins of shell-body.

** Number of radial grooves on the shell-body exclusive of auricles.

*** Newell (1937) calls such a specimen a subinternal mould.

muscle system. It may be primarily due to the complete erosion of inner aragonite layers on which those internal organs adhered.

Comparison:—The holotype left valve (Fig. 2b) is very similar to that of *Pleuronectites laterestriatus* (Philippi) (1899; Schmidt, 1928) in outline and radial grooves, but the radial striations are much finer and more partial in *laterestriatus* than in this species. That species is possibly a collateral ancestor to this species, although the right valve is fairly different in outline.

Pecten (Camptonectes) lens Leanza (1942) (non Sowerby) is another intimate species to this, judging from its ornamentation. But that species is different from this in the more *Chlamys*-like outline i. e. less sinuated antero-dorsal margin of shell-body and denser radial striae.

Chlamys sp. by Dechaseaux (1936, pl. 4, fig. 6) has a similar outline to the smaller paratype (Fig. 6a), although radial ornaments are entirely absent in that form. If it is a juvenalium, the French form may be more or less related to this.

Occurrence:—Common in the Liassic Kuruma group at Kuruma and Tsuchizawa in Kitaotari-mura, Kitaazumi-gun, Nagano Prefecture (Province of Shinano).

Radulonectites japonicus var. *convexus* Hayami, new variety.

Plate 16, Figure 8.

Represented by a right internal mould whose anterior part is broken. It dif-

Explanation of Plate 16

Radulonectites japonicus Hayami, new species. .....p. 90

Fig. 1a. Right valve, Paratype (MM 2690), ×1. Loc. Coarse sandstone of the Liassic Kuruma group at the lower stream of Tsuchizawa, Kuruma in Kitaotari-mura, Nagano, Pref. Prov. of Shinano).

Fig. 1b. Gypsum cast of the same external mould, × 1.

Figs. 2a–2b. Bivalved specimen, Holotype (MM 2689), × 1. Loc. ditto.

Fig. 2c. Gypsum cast of the same left external mould, × 1.

Fig. 2d. Radial ornaments in the ventral side of the same external mould, Holotype, × 2.

Fig. 3a. Juvenile right value (MM 2692), × 1.5. Loc. Black shale of the same group at Kuruma.

Fig. 3b. External mould of the same specimen, × 1.5.

Figs. 4a–4b. Bivalved specimen, (MM 2693), × 1. Loc. same as Fig. 1a.

Fig. 5. Left valve (?), (MM 2694), ×1. Loc. same as Figs. 3a–3b. Collected by Kobayashi.

Fig. 6a. Right valve, Paratype (MM 2691) ×1. Loc. Black fine sandstone of the same group at the middle stream of Tsuchizawa, Kuruma.

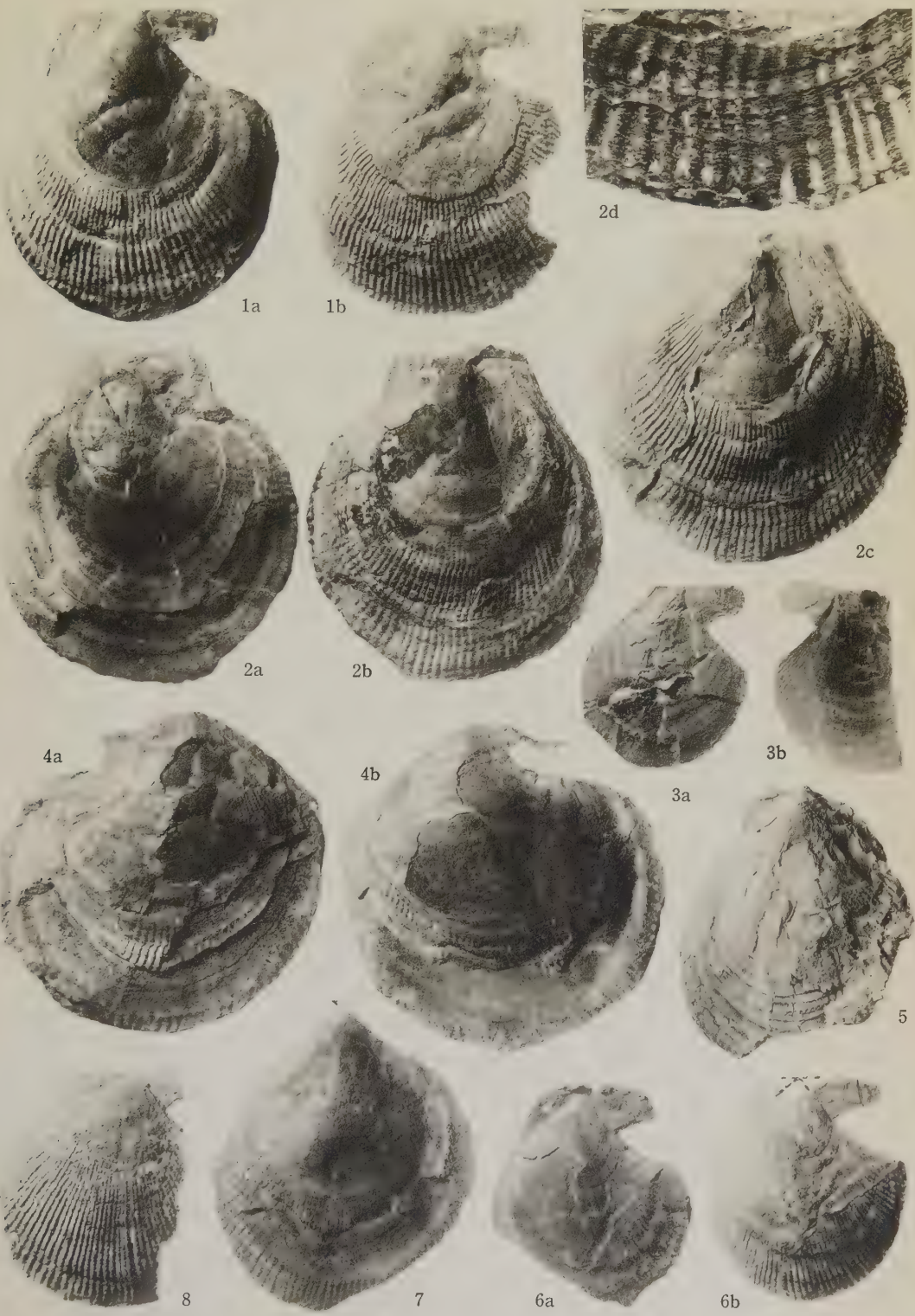
Fig. 6b. Gypsum cast of the same external mould, × 1.

Fig. 7. Left valve (MM 2695), × 1. Loc. same as Fig. 1a.

Radulonectites japonicus var. *convexus* Hayami, new variety. .....p. 92

Fig. 8. Gypsum cast of a right external mould (Holotype MM 2696), × 1. Loc. same as Fig. 6a. Collected by Matsuzawa.

All illustrated specimens are kept in the Geological Institute, University of Tokyo.


1a
1b
2d
2c
2a
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3a
4a
4b
5
8
7
6a
6b

fers from typical *japonicus* in the more inflated shell-body and radial grooves beginning earlier. Collected by Matsuzawa from the same group at Tsuchizawa.

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321. INTERESTING SAND-PIPES FROM THE MIOCENE TOYODA FORMATION, YAMAGATA PREFECTURE, JAPAN*

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山形盆地西縁部に発達する豊田層（中新世）から発見された興味ある Sand-pipe に就いて：山形県東村山郡左沢町の富沢東方最上川沿岸の，豊田層（中新世）中より採取した sand-pipe 様の構造をもつたものについて記載した。

Pipe 様のものと，層面，形および大いさ，特殊な ring あるいは同心円状の模様，埋蔵している沈積物の性質，および現在の海棲動物との照応，などとの関係から見て，この pipe は普通の sand-pipe とは異なつたもので，worm-cast あるいは pseudo-sand-pipe と称すべきものである。なお，今後更に研究を進めて行く予定である。

畑 井 小 虎

During the course of geological observations in the western marginal part of the Yamagata Basin, Yamagata Prefecture, in the early part of July 1956, the writer discovered some interesting sand-pipes of doubtful origin embedded in the Miocene Toyoda formation; these will be described in this article.

Before proceeding the writer wishes to express his thanks to Mr. Hirotoshi Aoki and Misses Tomoko Takeda and Toshiko Takahashi, students of the Tohoku University, for their cooperation in the field.

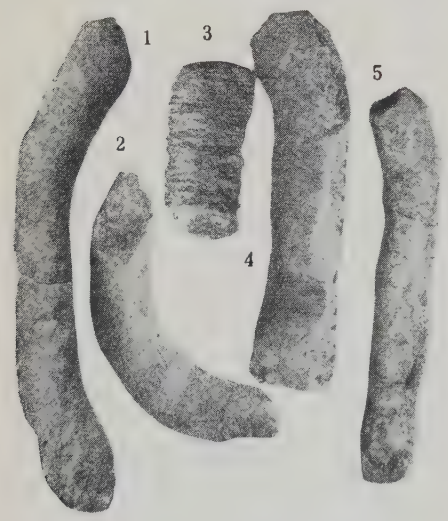
The sand-pipes above mentioned occur abundantly within a nearly 15 meters long exposure of the Toyoda formation on the right bank of the Mogami River below Tomisawa about 5 kilometers south of Aterazawa-machi, Higashi-Murayama-gun, Yamagata Prefecture. They are embedded in a fine-grained sandy tuff which occupies the middle part of the formation and occur without any definite orientation, but are quite parallel to the bedding plane. No fossils except occasional remains of drift woods were found in association with the sand-pipes.

The numerous pipes which measure about 1 centimeter in diameter and 15 centimeters in length of the longest exposed one, are either nearly circular or more or less flattened in cross-section. The sides are quite parallel with one another and the shape may be nearly straight, broadly to somewhat narrowly crescentic, more or less curved to somewhat sigmoidal, semi-circular or worm-like. As already mentioned, these pipes exhibit no definite orientation and show random arrangement, and the distance between each respective pipe is varied and some even overlap each other. None of the observable ones were found to be embedded vertically or at a highly oblique angle to the bedding plane of the stratum, although a few were found to be buried at a very low angle. Nearby, however, there were found a few in vertical position and of diameters similar to those already mentioned. This fact suggests that the origin may be due to some crawling organism.

* Received Dec. 26, 1956; read Dec. 1, 1956.

From the fact that the greater majority of the pipes were exposed with smooth external surfaces, it may be inferred that water current and probably also other agencies may have been responsible for wearing away any kind of sculpture that may have originally existed. Such inference is suggested from the fact that several pipes were found to have peculiar sculpture on their exposed surfaces as well on their half buried one (later proved by extracting from the matrix). This peculiar sculpture may help solve the nature of the pipes.

The peculiar sculpture consists of concentric rings numbering about 4 to 6 per 5 millimeters space. These are well rounded, elevated and with narrower interspaces and are parallel with one another. No striations other than the concentric rings were observed on any of the examined specimens. Although very faint, one was found to have a slightly greater number of weaker concentric rings within a space of 5 millimeters. These rings are less defined as to height and depth of interspaces probably due in part to the specimen having a smaller diameter (7 millimeters) as compared with the former which measured about 12 millimeters in diameter. Further, the specimen having stronger sculpture was better preserved than the one with weak sculpture.



Text-figs. 1–5. Worm-cast specimens collected from the Miocene Toyoda formation south of Aterazawa-machi, Higashi-Murayama-gun, Yamagata Prefecture. Figs. 1, 2, 4, 5, are more or less worn on their surface and thus do not show the typical concentric rings. Fig. 3, which is incomplete, shows the concentric rings. The specimens are all preserved in the collection of the Department of Geology, Faculty of Education, Tohoku University.

From the lengths of the pipe specimens as preserved and their diameters as well as from the concentric rings developed on them, it seems that some kind of annelid may have been responsible for their origin. Also from the lack of any definite arrangement of the pipes which are mostly parallel with the bedding plane with the exception of a few which were embedded with very low angle or more rarely with nearly vertical position, it may be suggested that the pipes are of organic rather than of inorganic origin and that some kind of marine organism is likely to be the cause.

Providing that the pipes are due to some marine organism, the problem arises as to what kind of organism could possibly make them. Marine worms belonging or related to such genera as *Arenicola*, *Balanoglossus* and *Chaetopterus* are worthy of consideration. However, all these genera live in burrows which are upright in position at their both ends and nearly horizontal at the middle lowest part, forming a U-shaped burrow or tube. In such respects, those genera may not have relation with the construction of

the present pipes which fail to show such orientation. Thus, another explanation must be considered.

Burrows parallel with the bedding plane are sometimes made by crabs as seen often along streams entering the sea. However, the present ones cannot be attributed to crabs because of their shapes and sizes, particularly because of their peculiar surface sculpture of concentric rings. Holuthurians such as *Cucumaria* crawl on sandy or muddy sea bottoms, but do not make such peculiar markings in so far as the writer is aware. Other crawling organisms as gastropods make trails but the present pipes are not trails later filled up. Presently the writer is unaware of the kind of marine organisms which could possibly make pipes similar to those now under consideration.

A possible cause resulting in the construction of various shapes of pipes, some of which show peculiar ring sculpture may be postulated as follows.

Should marine annelids as those belonging to or related with the genera *Arenicola, Balanoglossus* or *Chaetopterus* have their burrows gradually filled with fine-grained sandy tuff poor or almost devoid of organic matter utilizable as food and rich in acidic substances, they would be compelled to leave their burrows or remain to die. Since annelids are provided with organs for locomotion it may be considered probable that they would leave their burrows to migrate to a more favorable environment. By such procedure and from the fact that annelids often occur in great numbers, it may be inferred that many individuals would crawl over the surface of the sea-bottom at a similar time in search for a more favorable environment. Owing to the fine-grained sandy tuff being deposited continually on the sea-bottom the annelids may have not been able to endure the diverse conditions for any length of time. Possibly, although some may have been successful in finding new homes, the majority would have died in their attempt. If this is a possible case, then it is not to be questioned that many individuals would die in various positions. Some may have died with their bodies partly curved, others fully stretched and still others in positions of almost any shape. Some may have died in their attempt to crawl over others. Whatever be their position, it may be fully assumed that many individuals would be crawling over the sea-bottom at the same time and in position thus be parallel or nearly so with the substratum. By burial the fine-grained sediments would adhere to their bodies in a way to retain their smooth curvature and length, thus explaining the occurrence of various shapes and random arrangement on the bedding plane.

Should such a postulation be acceptable for explaining the various shapes of pipes which have similar diameters according to length and arranged parallel with the bedding plane, then the peculiar ring shaped sculpture on the better preserved ones would represent the original surface sculpture of the worms, which are thought to have relationship with the above mentioned three genera of worms. It may be added that the species belonging to the above mentioned three genera have strong segments, particularly on their anterior part of the body. Whether the above given explanation can be accepted remains to be settled by future studies. However, if it can, then it follows that the sand-pipes above described are not pipes in the general usage, but are casts of worms them-

selves and thus may be referred to pseudo-pipes or worm casts.

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322. ON SOME UPPER TRIASSIC SPIRIFERINOIDS FROM THE SAKAWA BASIN IN PROV. TOSA, JAPAN*

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土佐河内ヶ谷統産の Spiriferinoids 4 新種及び 1 新亜種：柏井産の 1 種 1 亜種は従来古生代の属として知られている *Punctospirifer* に属するが，sensu stricto のものに比べると，外形・装飾の点で多少異っている。他の河内ヶ谷産の 3 種は新属 *Spiriferinoides* に属する。この属は内部構造等の点で Spiriferinidae と Spiriferidae の中間的位置に来るが jugum の存在により前者に属する事が判った。Spiriferacea の系統発生の末期を示す型である。 徳山 明

One of the most common brachiopoda in the Trias of Japan is the Spiriferinidae occurring in the Skytic Kurotaki limestone in Tosa, in the Ladinic Rifu formation in Rikuzen and in the Carnic Kochigatani series in Tosa, Nabae formation in Tamba, and Iwai formation in Musashi (Kobayashi et al., 1950). Among them only 2 species from the Rifu formation have been described by Yabe and Shimizu (1297). In this paper the writer describes *Spiriferinoides*, new genus including 3 new species and 1 new species and 1 new subspecies of *Punctospirifer* North which has hitherto been a late Palaeozoic genus.

Palaeozoic spiriferoids are now well systematized. It is, however, not simple to adopt the scheme of classification to Triassic ones. The interior structure of *Spiriferinoides* is intermediate between the Spiriferidae and Spiriferinidae. More precisely, it agrees with the latter in the spiral structure of the arm, while the former family in the shell texture. Permian *Odontospirifer* Dunber may be a similar example having the shell of the former and the apical apparatus of the latter. In agreement with Williams (1956) and others, the writer is of opinion that the spiral structure is characteristic of spiriferoid. The genus may be a terminal branch of the Spiriferinidae.

The writer is thankful to Prof. T. Kobayashi who kindly bestowed the writer the privilege of describing his collection and always guides him.

Family Spiriferinidae

Genus *Punctospirifer* North, 1920

1920. *Punctospirifer* North *Q. J. G. S., vol. 76*, p. 212.

Choosing Avonian *Punctospirifer scabricostata* North for the type species, North discriminated this genus from *Spiriferina* d'Orbigny; its characteristics lie in the apical apparatus and V-shaped jugum. Since then, its wide distribution in Carboniferous and Permian was broutht to light. The writer is of opinion that the following species of *Spiriferina* from the South Alps etc.,

* Received Jan. 5, 1957; read at the Annual Meeting of the Palaeontological Society of Japan, Feb. 9, 1957, at Tokyo.

(Bittner, 1890) are probably its Triassic members.

"*Spiriferina*" *peneckei* Bittner
Anisic; South Alps.
"*Sp.*" *evanescense* Bittner
Carnic; S. Alps.
"*Sp.*" *gregaria* Suess
Carnic; N. & S. Alps, Himalaya etc.
"*Sp.*" *mojsisovicsiana* Klipstein*
Carnic; S. Alps.
"*Sp.*" *tyrolensis* Bittner
Carnic; S. Alps.
"*Sp.*" *griesbachi* Bittner
Noric; Himalaya.

Their shell texture and apical apparatus are quite suggestive of the generic reference. If compared to the Palaeozoic species they are, however, highly variable in external features, such as outline, costatum and median sinuatum. *P. triadicus* appears to be a terminal form. Its smooth lateral slope and very shallow mesial sinus are unusual for the genus; feeble costation of its variety suggests its relation to the costate form typical of the genus.

Punctospirifer triadicus Tokuyama, n. sp.

Plate 17, Figures 8–12 and Text-figure 1.

Description:— Shell small, biconvex, trigonally oval, wider than long, the greatest width lying in front of hinge-line. Pedicle vavle semiconical and inclined; beak small, pointed; median sinus shallow, flat on bottom and distinctly defined by boundary costae: anterior lobe rounded and slightly projected; lateral slope smooth. Brachial valve less convex than pedicle; median fold distinctly elevated above the general level of the valve; beak small, slightly raised on hinge line. Test endopunctate. No surface ornament except bundary costae and furrows.

Text-fig. 1. Apical apparatus of *Punctospirifer triadicus*.

Delthyrial supporting plates low, rectangularly divergent forward as far as the floor of valve in a very early stage, but reduced in maturety to stout flanges in cardinal area; median septum high, free from delthyrial supporting plates, and extends to a third of length below beak; a crest on brachial valve low, narrow and supporting hinge socket near beak.

Measurement in mm.	Length	Width	Thickness
Holotype (pedicle valve)	7.5	8.9	—
Paratype (pedicle valve)	6.8	8.1	3.1
Paratype (brachial valve)	7.3	8.0	3.6

Observation:— As seen in many shells, punctation is fine, distinct, and somewhat crowded in the inner layer of test (fig. 9), but there is no trace on external moulds. No dorsal interior structure is known except a short crest in the beak region.

* Wang (1955) referred this to Middle Triassic *Lepismatina* Wang, but Bittner's (1890) illustration (Taf. 40, Fig. 26) suggests this to be "tripartitae" of Zugmayer (1882).

Comparison:—Its test and apical apparatus of both valves are typical of *Punctospirifer*, although no specimen shows the V-shaped jugum. *P. scabricostata* North and many other Palaeozoic members which have roundly sinuated wide median sinus and numerous fine and distinct ribs; this differs from them in the shallow median sinus, its flat bottom and smooth lateral slopes except strong boundary costae. This species is quite distinct also from the above listed Triassic members. In the ornamentation it resembles "*Sp.*" *halobiarum* Bittner from the Carnic of North Alps, but that species is non-punctate. Superficially, *Sp.* cf. *darwini* Demmellaro by Wanner and Knipscheer (1951) from the middle Lias of Niefschrucht is closest to this, although the area is higher in that than in this species. Details of the interior are unknown either of *S. halobiarum* or *S.* cf. *darwini*.

Occurrence:—Very common at Kashiwai and Okunomine-tani near Sakawa in Prov. Tosa, in the Carnic *Oxytoma-Mytilus* bed of the Kochigatani series. All specimens are collected from fairly coarse sandstone, containing a terebratulid and various pelecypods.

Punctospirifer triadicus kashiwaiensis Tokuyama, new subspecies

Plate 17, Figures 13–16.

Somewhat larger than the typical form; median sinus shallow, provided with a faint mesial rib and bounded by distinct costae; lateral plicae 3–4, weak and widely spaced. In most features this agrees with the preceding. In some specimens plicae are almost obscure but in others fairly distinct, like in *P. mojsisovicsiana* (Bittner); its biconvexity is clear distinction.

Measurement in mm.	Length	Width
Holotype (pedicle v.)	10.5	14.5
Paratype (brachial v.)	7.2	9.5

Occurrence:—Same as preceding.

Genus *Spiriferinoides* Tokuyama, new genus

Type species:—*Spiriferinoides sakawanus* Kobayashi and Tokuyama, n. sp.

Diagnosis:—Shell small, semiconical, almost planoconvex, wider than long, widest slightly anterior to hinge line. Pedicle valve convex, with a rounded median sinus; anterior lobe indistinct; beak pointed, more or less gibbous; area slightly concave; lateral slope covered by about 5 to 7 distinct costae. Brachial valve flattened; beak slightly raised above hinge line. Test pseudopunctate; surface covered by distinct and comparatively coarse spines and by imbricating lamellae near periphery.

Internally, delthyrial supporting lamellae absent or weak in the apex of pedicle valve; delthyrial carinae supporting hinge teeth of moderately strength; ventral median septum high, well developed and free from the carinae. Brachial valve bears no septum apically; spiralium composed of about 6 volutions, apices of which being normal to median axis and their anterior part spinose; jugum of a slender band more or less zigzag, slightly arcuate ventrally and connecting primary coils of spiralium near junction of crura.

Species:—(1) No dental lamellae can be recognised in these forms such as *S. yeharai* Kobayashi and Tokuyama n. sp., *S. nasai* Tokuyama n. sp., both from Carnic of Japan; and *S. sublilangensis* (Krumbeck) from Upper (?) Trias of

Timor. (2) Degenerated delthyrial supporting lamellae can be seen in the apex in *S. avarica* (Bittner) from Anisic of Bakony etc., *S. fortis* from Carnic of South Alps, *S. subgriesbachi* (Krumbeck) from Timor, and *S. lilangensis* (Stoliczka) from Anisic of Himalaya.

Distribution:—Middle and Upper Trias; Japan, Timor, Himalaya and Alps.

Remarks:—As listed above, this genus comprises two kinds with regard to apical apparati. One group has no delthyrial supporting plates, but in the other faint delthyrial lamellae are found only in the apex. The former is of *Mentzelia* Quenstedt type, and the latter is of Palaeozoic *Punctospirifer* or *Odontospirifer* type.

This genus resembles *Spiriferina* in its brachidial part, especially in the simple band of jugum and anteriorly pointed coils, but can easily be distinguished by its pseudopunctate shell and the degenerated apical apparatus of its pedicle valve. Superficially, this resembles *Mentzeliopsis* Trechman from the Triassic of New Zealand, but may not be related because the juga are apparently discrete and dental lamellae well developed in the latter. The apical apparatus of this genus is unique among spiriferoids. According to the Fredericks (1927) and Paeckelmann (1931), *carinae delthyriales* is one of the primitive structure and not associated with the ventral median septum; apical apparatus in *Mentzelia* is similar, although the median septum in this is a true septum. The writer is of opinion that the delthyrial carinae in this genus are degenerated instead of primitive. The well developed median septum and delthyrial flanges are two of the important characteristics of *Punctospirifer* North and *Odontospirifer* Dunber (1955). In them dental lamellae are developed apically, but in the typical *Spiriferinoides* there is no structure except "callosity"-like thickning of test in the apex. Moreover, there is no septum near the apex in the brachial valve.

These three features are important specialities of the spiriferoid group. Which one of them bears the greatest importance for phylogenetical consideration is a fundamental problem. Williams (1956), however, suggests the importance of calcareous secretion on the classification of brachiopods. According to him spires and loops are preeminent characteristics of spiriferoids and should have played an important role in their classification. The shell structure is also highly evaluated in the classification by some authors. It is said that a certain genus comprises both pseudopunctate and impunctate shells (Öpik 1934, cited in Cooper 1956 and Williams 1956). The writer has at present no definite opinion, but tentatively takes in the brachidium superior to the shell structure. Fredericks (1918) and Paeckelmann (1931) laid special stress on the apical apparatus, but it may not be so important for this genus because it comprises two kinds; they probably show different steps of degeneration. Finally the writer is of opinion that this genus is a derivative of the Spiriferinidae.

Spiriferinoides sakawanus Kobayashi and Tokuyama, new species.

Plate 17, Figures 1, 2 and Text-figure 2.

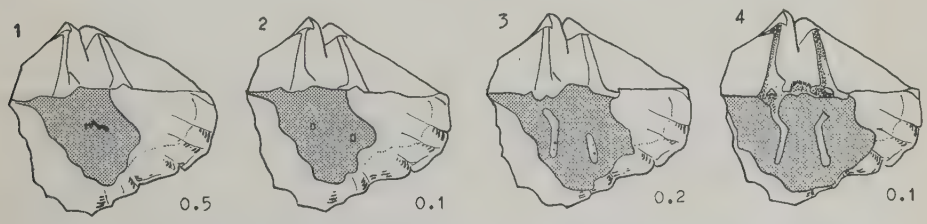
1931. *Spiriferina sakawana* Kobayashi, *Jour. Geol. Soc. Tokyo. vol. 38*, p. 231 (listed).

Description:—Shell small, semiconical almost planoconvex and wider than high, widest at a little anterior to

hinge line. Pedicle valve convex, semiconical; a median sinus wide and rounded; anterior lobe rounded but not distinct; beak small, pointed and more or less gibbous; area erect, fairly flattened, and faintly striated transversely. Costae on lateral slope 5 in number, distinct and subangular, most lateral one weak, disappearing toward beak; lateral area or interspace between most lateral costae and areal edge narrow; cardinal extremity subangular. Brachial valve flattened; beak slightly raised on hinge line; mesial fold well developed rounded, and moderately raised above general level of valve. Surface of shell marked by a concentric imbricating lamellae of growth. Test pseudopunctae; outer shell layer covered with fine and rather crowded tubular spinose projections (Fig. 1f), but inner layer is impunctate.

Measurement in mm.	Pedicle valve			Area		Brach. v.
	Length	Width	Height	Width	Height	Length
Holytype (both valve)	10.5	7.8×2	7.1	4.9×2	4.2	8.1
Paratype (pedicle valve)	9.1	19.0	6.1	14.5	4.5	10.3
Paratype (both valves)	14.5	10.6×2	—	9.6×2	5.0	9.3

Observation:— Serial sections show that the pedicle valve bears on delthyrial supporting plates, but a pair of delthyrial carinae below a faint apical callosity; median septum high and well developed on the floor for about a third of the valve below the apex and extending to the level of the area near the apex. The brachidial spires are large, coiling for 6 times and have their apices approximately normal to the axis; their anterior portion is spinose. The jugum is a simple transverse band, more or less zigzag, arcuate



Text-fig. 2. *Spiriferinoides sakawanus*; serial section showing jugum, first coil and delthyrial carinae; ×2.

dorsally and connecting the primary lamellae of spires near their junction with crura, which are triangular processes, and developed almost horizontally. Hinge plate is narrow; teeth of moderate strength (text-figure 2).

Externally, spines are not long and clearly seen in the shell surface but indiscernible in the inner mould; their distribution is dense and irregular.

Comparison:—This resembles *S. sublilangensis* (Krumbeck) from Timor; but differs in its weak delthyrial supporting plates near apex and in its

strongly projected anterior lobe; Krumbeck's brachial valve is more convex; moreover, "tubercles" are radially arrenged on the shell surface. Superficially, this resembles *Mentzeliopsis spinosa* Trechman from the Ladino-Carnic of New Zealand, but it is easily distinguishable by its apical apparatus and jugum; the tubular spines are longer in that than in this species.

Occurrence:—Common at Tokombo and Nakajima in Kochigatani, and Shimoyama in the Sakawa basin, Prov. Tosa, in the Carnic *Halobia-Tosapecten* bed in Kochigatani series, containing many rhynchonellids and pelecypods.

Spiriferinoides yeharai Kobayashi and Tokuyama, new species.

Plate 17, Figures 3–5.

1928. *Spiriferina* sp. Yehara, *J. J. G. G. vol. 5*, p. 28, fig. 12.

1931. *Sp. yeharai* Kobayashi, *Jour. Geol. Soc. Tokyo, vol. 38*, p. 231 (listed).

Description:—Shell nearly planoconvex, 1.5 times wider than long; apical angle obout 120 degrees; largest width slightly anterior to hinge line. Median sinus of pedicle valve not broad; anterior lobe absent: 5–7 lateral costae rounded, widely spaced, narrowing and weakening laterally; lateral one or two costae disappear toward border of narrow lateral area; beak pointed and gibbous; area concave, not high, median 1/5 of which is occupied by delthyrial opening. Brachial valve flattened, subcircular and provided with a median fold through its length; costae 6 to 7 strong and rounded. Imbricating lamellae and spines distinct near periphery.

Measurement in mm.	Pedicle valve			Area		Brach. v.
	Length	Width	Height	Width	Height	Length
Holotype (pedicle valve)	9.5	15.5	5.6	12.6	3.5	—
Paratype (ditto)	10.0	15.9	6.8	6.0×2	5.1	—
Paratype (both valves)	9.1	19.0	6.1	14.5	4.5	10.3

Observation:—The delthyrial supporting-plate in the pedicle valve is practically undeveloped; a pair of very weak and short lamellae near the apex diverging forward an obtuse angle and detouched from the floor of the valve; stout cardinal carinae connecting at apical callosity; median septum on the shell floor as long as about a half of the valve and extending in the level of interarea near the beak. No internal character of the brachial valve is known. Imbricating lamellae near periphery are not so distinct as in the preceding; pseudo-exopunctae are often seen in the other part and are impressions of "taleolae" (Williams, 1956).

A juvenile form bears 3 rounded costae on each lateral slope; the ratio of its width to length in this specimen is nearly equal to that in the adult form.

Comparison:—Judged by the apical apparatus, shell structure and general outline, this species belongs decidedly to *Spiriferinoides*. It is distinguished from the typical form of the genus by its less significant anterior lobe, rounded and more widely spaced costae and the broader outline from young stages. Moreover, the ventral median septum is longer in this than in the preceding *S. avarica* (Bittner) from

Anisic of South Alps, etc. is another ally, but this is different in its weaker and narrower boundary costae.

Occurrence:—Common at Shimoyama, Tokombo and Nakajima in the Sakawa basin, Tosa, in the Carnic *Halobia-Tosapecten* bed of the Kochigatani series.

*Spiriferinoides nasai** Tokuyama, new species.

Plate 17, Figures 6, 7 and Text-figure 3.

Description:—Shell small, semiconical and plano-convex. Median sinus of pedicle valve wide, very shallow and bearing a faint narrow mesial costa on its anterior half; cardinal extremities broadly rounded; area triangular, normally erected; lateral slope covered by 4 subangular, narrow, but widely spaced costae. Brachial valve slightly convex, rounded trapezoidal, with 4 lateral costae and a faint mesial furrow.

Text-fig. 3. Hinge plate of *Spiriferinoides nasai*.

Observation:—Internal moulds of a pedicle and a brachial valve are fairly well preserved. The apical apparatus of the pedicle valve (holotype) is same as the preceding. Apically, the brachial valve (paratype) bears a shallow and narrow furrow, which divides musclar impressions and turns into a mesial projection in the posterior half of the valve; hinge plate wide and long, with a pair of stout hinge sockets and transverse grooves on both sides of the central triangular pit (text-figure 3).

Measurement in mm.	Width	Length	Height	Width of area
Holotype (pedicle valve)	12.6	7.9	5.3	9.5
Paratype (brachial valve)	10.7	7.1	—	

Comparison:—Although little is known of the interior structure and shell texture, its outline and apical apparatus suggest that this is congeneric with the preceding. The well developed hinge plate as in this is unusual for the genus; such a plate is, however, seen in "*Spiriferina*" *fragilis* Schlotheim from Württemberg (Bittner, 1890, pl. 35 fig. 34), although this can easily be distinguished by its apical apparatus and its shell substance.

Occurrence:—Rare at Kuromagari, Shimoyama in the Sakawa basin in Prov. Tosa, in the Carnic *Halobia-Tosapecten* bed of the Kochigatani series.

* This species is established in memoir of late Mr. T. Nasa, who studied first on the geology of the Sakawa basin in 1885.

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Explanation of Plate 17

Figs. 1–2. *Spiriferinoides sakawanus* Kobayashi and Tokuyama, new species. ..... p. 102
1a–f: Holotype, external and internal mould of both valves; × 2 (except f); loc. Tokombo. Kobayashi coll. a–d: views from 4 directions; a: brachial, b: pedicle, c: areal and d: lateral view; f: enlarged external mould (× 5) showing impressions of taleolae.
2: Paratype, internal mould, brachial view, showing apical apparatus; × 2; loc. Nakajima.

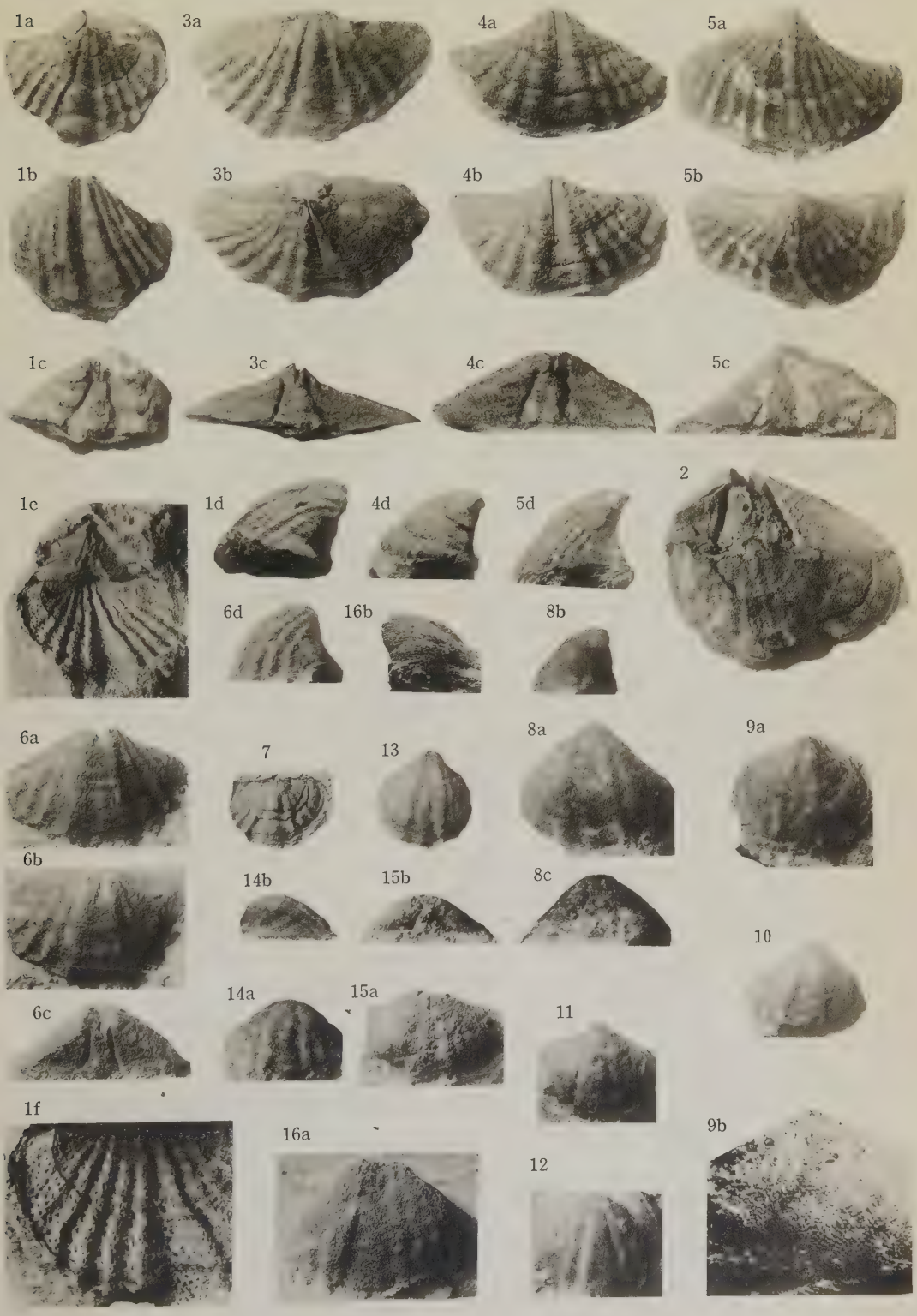
Figs. 3–5: *Spiriferinoides yeharai* Kobayashi and Tokuyama, new species. ..... p. 104
3a–c: Paratppe, internal mould of both valves; × 2; loc. Nakajima.
4a–d: Holotype, internal mould of pedicle valve; × 2; loc. Shimoyama.
5a–d: Paratype, internal mould of pedicle valve, partly keeps its shell; × 2; loc. Kuromagari (?). Kobayashi coll.

Figs. 6–7: *Spiriferinoides nasai* Tokuyama, new species. ..... p. 105
6a–d: Holotype, internal mould of pedicle valve; × 2; loc. Kuromagari.
7: Paratype, internal mould of brachial valve; × 1; loc. Kuromagari. All Kobayashi coll.

Figs. 8–12: *Punctospirifer triadicus* Tokuyama, new species. ..... p. 100
8a–c: Holotype, pedicle valve; × 3; loc. Okunominetani.
9a, 10: Paratypes, pedicle valves, × 3; 9b; Punctation of shell, × 5; loc. ditto.
11–12: Paratypes, brachial valves; × 3; loc. Okunominetani. All Kobayashi coll.

Figs. 13–16: *Punctospirifer triadicus kashiwaiensis* Tokuyama,, new subspecies. ..... p. 101
13: Paratype, brachial valve; × 2; loc. Okunominetani. Kobayashi coll.
14a, b: Paratype, brachial valve; × 2; loc. Kashiwai.
15a, b: Paratype, internal mould of pedicle valve; × 2; loc. Owada-Horiake. Kobayashi coll.
16a, b: Holotype, internal mould of pedicle valve; × 2; loc. Owada-Horiake.

All specimens illustrated here are preserved in the Geological Institute, University of Tokyo.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Ueki Photo.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 27, pp. 107-109, pl. 18, Sept. 30, 1957

323. SOME NOTES ON A RARE SPECIES *TRICERATIUM SIMPLEX* J. BRUN*

WATARU ICHIKAWA

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稀有珪藻の一種, ***Triceratium simplex*** J. BRUN について：1954年7月に当時帝石の技師であつた新保久称氏から，未知の微化石の標本を送られた。ここに述べる稀有珪藻の1種はこれである。その後数個の標本を追加され，初めてこれが *Triceratium* 属であり，しかも既知の ***Triceratium simplex*** J. BRUN であることがわかつた。

市 川 渡

Introduction

Since 1954-1955, I had an opportunity to examine many boring cores for oil prospecting of the Teikoku oil company, and I made a special study of fossil diatoms in the cores. But I did not found a rare species of the above heading. In July 15, 1954, Mr. H. SHIMBO who was an oil engineer at that time sent me some unknown specimens collected from the core of the Iwata test boring R-1. Thereafter, in July 9, 1956, he again sent me same specimens, some of which are collected from a core of the Itsuka-machi test boring R-1.

Such a form is rarely to be met with, in microorganisms of our country, so I would like to put down my observations concerning this rare form.

I wish to express my thanks for Mr. H. SHIMBO, who has sent me the best specimens in his collections.

Geological Consideration

The geology of the Japanese oil field has been discussed by many geologists, and they have paid particular attention to the occurrence of various sorts of black shale and mudstone. Some microfossils as diatoms, pollens, sponge spicules, etc. broadly occur in these muddy beds.

Mr. SHIMBO assigns that the age of these beds from which the specimens were collected belongs to a period from the Upper Miocene to the Lower Pliocene, showing the following table:

Age		Formation, Member, Bed	Well	Depth
Pliocene	H_1	Hamatsuda alternation member or Lower part of Nishiyama formation	Iwata R-1	391.50 m
Miocene	G	Nunagawa beds or Upper part of Siiya formation	Itsuka-machi R-1	452.00 m
		Teradomari formation Nanatani formation	Itsuka-machi R-1	543.00 m

* Read Feb. 9, 1956; received Dec. 26, 1956.

The Iwata test boring R-1 situates on the south-western vicinity of Nagaoka City, Niigata-prefecture. The specimens are collected from part of the core of 391.50 m in depth, which geologically belongs to the Hamatsuda alternation member (or Lower part of Nishiyama formation).

The Itsuka-machi test boring R-1 lies in the northern part of Uonuma-subprefecture, Niigata-prefecture. Some of these specimens were collected from a core of 452.00 m in depth, which belongs to the Nunagawa beds (or Upper part of Siiya formation), and the other was collected from a core of 543.00 m in depth, which belongs to the Teradomari formation.

Generally speaking, the specimens are frequently found in the Hamatsuda member and the Nunagawa beds. But in other places, they are only found near boundaries of each formation.

Description

The outline of the frustules of diatoms takes varied forms. Among them, triangular forms can be separated as one group from all their allies, and it is also distinguished by the absence of a pseudonodules from them. Such a genus is called *Triceratium*. To ascertain the true form and structure of the valve requires a careful examination, not only of living, but of fossil specimens. But in some of fossil forms, true characters of their skeleton can not easily be understood. I think it is almost the same with the present case.

The form described here is perhaps derived from the triangular form of the valve, and the three-lods radiating from the center of an equilateral triangle well develop into the skeleton and the other part of the triangle waste away into nothing(Pl. 18; figs. 5, 6). But in some specimens, all parts of the triangle remain to the last (Pl. 18; figs. 1, 2). If the test is put back in its original form, it will show a triangle form as the structure of the valve. The one side of the triangular form measures 100 to 160 μ in length.

This form also differs from other triangular species except *Triceratium* such as *Schutta annulata* (Wall.) De Toni, *Trinacria regina* Heib., and *Fragilaria construens* (Ehr.) Grun. var. *exigua* (W. Smith) Schulz, in absence of characteristic markings of its valve and size of species.

This genus, as the name implies, is characterized by a triangular form of its valve, and the markings on the valve are very important for determination

Explanation of Plate 18

Triceratium simplex J. Brun

Figure 1. Triangular form.....In the core of the Iwata R-1 (391.50 m).
Figure 2. Triangular form.....In the core of the Itsuka-machi R-1 (543.00 m).
Figure 3. Intermediate form.....In the core of the Iwata R-1 (391.50 m).
Figure 4. Intermediate form.....In the core of the Itsuka-machi R-1 (542.00 m).
Figure 5. Triple-headed form ...In the core of the Iwata R-1 (391.50 m).
Figure 6. Triple-headed form ...In the core of the Iwata R-1 (391.50 m).

All specimens are preserved in the collection of Faculty of Science, Kanazawa University.


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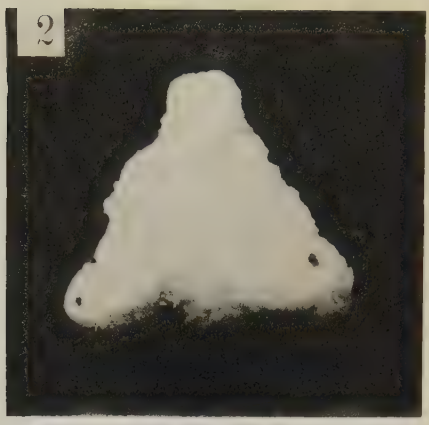
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of species. In this case, the dim markings on the valve can not be confounded with any other, such as *Triceratium tripolaris* Temp. et Brun, and *Triceratium schlumbergeri* Temp. et Brun. However, this form and *Triceratium simplex* J. Brun are so closely allied with each other, that it is only too difficult to assign precise characters to each by a verbal description.

Conclusion

The species described here was found in the period from the Upper Miocene to the Lower Pliocene in the Neogene Tertiary of Japan. J. Brun and J. Tempère first described *Triceratium simplex* as *Très rare*, showing a characteristic figure in their works. The species in Japan reported in 1889 by them was found from *Calcaire de Yédo*. But they did not indicate its true locality in Yedo and the geological age of the bed where the species was found. If the several specimens mentioned above had not fallen into my hand, it would have remained a question whether such a triple-headed form ever belong to a diatom or not. But as Pl. 18 shows, these specimens can easily arrange themselves one after another according to their forms. The dim markings on its valve and the arrangement of the three lods in one plane show the form of *Triceratium simplex* J. Brun.

I can not find such a form in other papers already published in our country, and it is also true that the species is very rarely to be met with in other countries.

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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

「日本古生物学会第66回例会」1957年6月15日秋田大学鉱山学部教室に於いて開催した（参会者20名）。例会に於ける講演者並びに講演題目は次の通りである。

1. 秋田油田に於ける *Miogypsina kotoi* の新産地とその地質学的意義 ……井上 武
2. 千葉県いなり山のコケムシ化石層について（代読）……高橋直二
3. 仙台付近中新統産 Pectinidae, pt. 10, *Pecten* (*Chlamys*) *crassivenia* YOKOYAMA について（代読）……増田孝一郎
4. 同 上 pt. 11, *Pecten* (*Aequipecten*) *yanagawaensis* NOMURA & JIMBO について（代読）……増田孝一郎
5. 同 上 pt. 12, *Pecten* (*Patinopecten*?) *kagamianus* YOKOYAMA について（代読）……増田孝一郎
6. Invalid Names of Japanese Molluscs（代読）……大山 桂
7. On some Cephalapsid Opisthobranchia from the Japanese Miocene……Junji ITOIGAWA
8. Species of the genus *Neptunea* from the Palaeogene Formation in the Kushiro Coal Field, Hokkaido, Japan（代読）……Masaru MATSUI
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13. Notes on Two Devonian Trilobites in Japan（代読）……Teiichi KOBAYASHI
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16. New Neogene species of *Platanus* from Japan……Keiji SUZUKI
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18. 夕張炭田清水沢炭鉱夕張層産の Juglandaceae 化石……藤岡一男
19. 夕張炭田清水沢炭鉱夕張層産の羊歯類化石……藤岡一男
20. 日本古第三紀 Liquidambar について……藤岡一男
21. 山口県産第三紀植物化石（その1）……藤岡一男・高橋英太郎
22. *Sabalites* aus der Wakata Formation von Tsushima, Nordkyushu（代読）……Kiyoshi TAKAHASHI

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